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Notes on Costa Rican Centrolenidae With Descriptions of New Forms

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ABSTRACT: The Costa Rican species of this family are discussed and distributional data listed. Four species are described as new: *Cochranella chirripoi*, *Cochranella millipunctata*, *Cochranella decorata*, and *Cochranella reticulata*. A key is given. Thirteen of the species are illustrated with photographs.

INTRODUCTION

Four species of diminutive frogs taken since the preparation of my paper "A Review of the Frogs and Toads of Costa Rica" are referred to the family Centrolenidae. Seemingly they are new and are described herein. In order to facilitate identification of these and other species of this difficult group, I append a brief key to the Costa Rican centrolenids and list such distributional data for the members of this family as are presented by the material in my collections.

The Costa Rican species of the Centrolenidae have the following characteristics in common: The astragalus and calcaneum are fused into a single slender element; the eyes are large, usually protruding beyond the edge of the mouth and directed forward to a greater or lesser extent; the head is usually but perhaps not invariably wider than the body. The usual dorsal coloration in life is some shade of green, but in preservative the chromatophores become lavender (magenta to purplish). In the dentate species this pigment is seemingly less soluble in preservatives than in the species lacking vomerine teeth. In certain forms, and more especially so in males, the forearm is much widened in comparison with the upper arm, and the musculature tends to prevent the straightening of the member unless the muscles or tendons are torn. In life the

arms seem to be less flexed permanently. In many of the species the skin and musculature of the venter, often also of back and limbs, are so transparent that the viscera and bones may be seen through the flesh.

Several species have the eyeball surrounded by a creamy or whitish membrane which may be seen through the skin of the upper eyelid or seen from within the mouth. In others the eyeball is black. In *Cochranella chirripoi* there was seemingly some variation as if this tunic might be retracted to some extent. This I cannot determine. In many species much of the intestine has a cream-white covering.

After a specimen has been preserved for some time the brain often can be seen with considerable clarity and certain muscles will appear different in color from other muscles, thus suggesting a color pattern.

All of the species have the terminal phalanx of the digits Y-shaped, T-shaped, or straight, and the variation may occur on different digits of the same specimen. They are never clawlike as in the Hylidae, but there is an intercalated cartilage between the two terminal bones of the digits (as is true of the Hylidae and certain other arboreal frogs).

KEY TO COSTA RICAN CENTROLENIDAE
(based on preserved specimens)

- | | |
|--|---|
| 1. Vomerine teeth present. In preservatives, considerable diffuse lavender pigment (magenta to purple) giving specimens a general lavender color..... | 2 |
| Vomerine teeth absent. Lavender pigment tending to dissolve in preservatives leaving specimens without pigment (except in eye), | 6 |
| 2. A bony process on humerus in males (rarely visible in certain females); part of lavender pigment tends to form small punctate spots (often absent); 28 mm..... <i>Centroleue prosoblepon</i> | 3 |
| No bony process on humerus visible externally..... | |
| 3. A pollex rudiment, in males bearing a sharp spine; 20 mm.,
<i>Teratohyla spinosa</i> | |
| No pollex rudiment, bearing a sharp spine in males. | |
| 4. Skin smooth on dorsum; no web-remnant between first two fingers; outer fingers four-fifths webbed; dorsum with minute lavender flecks and fine scattered white punctations; toes entirely webbed; 24 mm..... <i>Cochranella pulverata</i> | 5 |
| Skin more or less distinctly granular on dorsum; size larger..... | |
| 5. Dorsum dark lavender above enclosing discrete rounded cream-white spots; this color also on upper part of thighs, tibia, and tarsus, where the cream spots are larger; legs slender, elongate; terminal | |

pads rather widened; eyes very large, head wider than body; interorbital distance less than width of an eyelid; 29.5 mm.,

Cochranella albomaculata

Dorsum light lavender with numerous (40-50) dark rounded lavender spots, absent on arms, thighs, and tarsus; present on tibia; interorbital distance much greater than width of an eyelid; terminal pads on fingers widened; dorsal granules stronger; 30.2 mm.,

Cochranella granulosa

6. Tympanum concealed; areas about nostrils flattened, not swollen or inflated 7

Tympanum visible though covered with a thin pigmented skin; areas about nostrils swollen; the snout, sometimes nostrils, extending beyond mouth level..... 10

7. A pair of discrete folds, lateral to vent, run diagonally back and down on thigh *Cochranella decorata*

No pair of distinct folds in region of vent 8

8. Terminal digital pads enlarged, rounded, distinctly wider than adjoining part of digit; a white eye tunic, 23.8 mm.,

Cochranella millepunctata

Terminal digital pads truncate or subtruncate, not or only a little wider than adjoining part of digit 9

9. A distinctive white eye tunic, visible through upper eyelid as a white spot; 25 mm..... *Cochranella fleischmanni*

A black eye tunic, the upper eyelid appearing dark; hand proportionally larger; 24 mm..... *Cochranella chrysops*

10. Web between second and third fingers equally as extensive as that between third and fourth. Usually a white eye tunic; 25 mm.,

Cochranella chirripoi

Web between second and third fingers not as extensive as that between third and fourth 11

11. A coarse reticulation of lavender enclosing irregular light areas on dorsum and limbs; nostril area moderately inflated, not extended quite to level of mouth; eye tunic dark; tympanum large, directed upward; a strong tarsal fold, and a strong fold from wrist to elbow; most subarticular tubercles double; 25 mm. *Cochranella reticulata*

No coarse reticulation enclosing light areas; area about nostrils somewhat more inflated 12

12. Interorbital distance double width of eyelid; visible part of tympanum one sixth of eye length; nostrils protruding beyond level of mouth; tibiotarsal articulation reaches tip of snout; no pigment on thighs; 22 mm. *Cochranella valerioi*

Interorbital distance not twice width of eyelid; tympanum larger 13

13. Eye tunic white; a reticulation on dorsum tending to enclose lighter spots in vertical series; area about nostrils inflated but not extending beyond lip; tympanum directed somewhat upwards; width of eyelid in interorbital distance, twice; 22 mm.,

Cochranella talamancae

Eye tunic black, choanae relatively large, interorbital distance one-fourth greater than width of eyelid; 26 mm.,

Cochranella colymbiphylum

TAXONOMIC TREATMENT

Centrolene prosoblepon (Boettger)

(Fig. 1)

This species, with a type locality "plantage Cairo" (La Junta) near Limón, Limón Province, Costa Rica, has a considerable range in Costa Rica and is likewise known from Panamá and Barro Colorado Island. It occurs on both Caribbean and Pacific slopes. It also has a considerable vertical range, occurring from near sea level to elevations of from 4000 to 5500 feet.



FIG. 1. *Centrolene prosoblepon* (Boettger). KUMNH No. 32932 ♀ (showing traces of the humeral processes). Turrialba, Cartago Province, C. R. Actual snout-vent length, 20 mm.

Specimens in the Kansas collection are: Pacific drainage. KUMNH Nos. 32390-93, 12-15 km. WSW of San Isidro del General, San José Province; Nos. 36874-76, Agua Buena near Cañas Gordas, 2000 + ft. elev., Puntarenas Province; Nos. 32927-32, 36877, near Sarchi, Alajuela Province.

Caribbean drainage. KUMNH Nos. 32419-38, 36873, 37016, Cinchona, southeastern slope Volcán Poás 5000-5500 ft. elev., Heredia Province; Nos. 32803-05, 32806, Los Diamantes, near Guápiles, Limón Province; Nos. 30403, 32376-81, 32926, Moravia de Chirripó, Limón Province. Nos. 32396-32416, Cariblanco, Limón Province; No. 32395 Cartago, Cartago Province; Nos. 32385-89, near Pacayas, Cartago Province; Nos. 32382-84, Santa Cruz, Cartago Province.

The lavender pigment in these, once the specimens were preserved, is practically unchanged after ten years. One female, KUMNH No. 32932, has been found showing a small humeral process, visible externally.

Teratohyla spinosa (Taylor)

(Fig. 2)

Centrolenella spinosa Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 1, Apr. 20, 1949, pp. 259-262 (type locality, Los Diamantes near Guápiles, Limón Province, Costa Rica).

Three more topotypic specimens, KUMNH Nos. 32933-35, were taken at Los Diamantes, Limón Province, within a few meters of the exact type locality, August 13, 1952. In life the colors were: "Body nearly uniform green above, yellowish on sides of head; ground color flesh; venter greenish or transparent flesh; terminal digital pads yellowish; iris dark without whitish flecks. The bones, visible through the flesh, green."



FIG. 2. *Teratohyla spinosa* (Taylor). KUMNH No. 32934 toptype, Los Diamantes, near Guápiles, Limón Province, C. R. Actual snout-vent length, 20.2 mm.

I have examined a specimen of this species from Barro Colorado Island, Canal Zone, identified as *C. pulverata*. It may be presumed that it occurs in suitable localities along the eastern lowland of Costa Rica and into Panamá.

The lavender pigment, visible after preservation (after the green color disappears), is less soluble than in many species of *Cochranella*. The types appear practically unchanged after nearly ten years of preservation.

Cochranella pulverata (Peters)

(Fig. 3)

Hyla pulverata Peters, Monatsb. Akad. Wiss. Berlin, 1873, p. 614 (type locality "Chiriqui" Panamá).

I have traced this species to the north on the Pacific slopes as far as Sarchi, Alajuela. Dunn reports the species in Colombia and Ecuador. He also reports a specimen from Turrialba, Costa Rica. I have not seen this specimen, but I suspect that this may represent the related species *Cochranella albomaculata*. I have not seen his South American specimens of *C. pulverata*.

There are five specimens in our collection: KUMNH Nos. 36871-72, 32822-23, are from Sarchi, Alajuela Province; No. 32821 from San Isidro del General, San José Province. All are dark lavender on their exposed surfaces, with minute light dots indicated. There is a line of pigment on the upperarm and on the dorsal surface of the thigh. Below, the venter and concealed parts of the limbs are clear flesh color. The digital tips are bright orange. The vomerine teeth are present in the adults and seemingly absent in the young. The two females measure 24 and 25 millimeters, snout to vent. The largest male is 23.5 millimeters.

The relationship of the species is with *Cochranella albomaculata*. In the latter the heel extends three millimeters beyond the tip of the snout and the bones are not green in preserved specimens. The species is larger (29 mm.) with the webbing on digits distinctly greater. The toes are wider, with wider terminal pads.

The lavender pigment remains practically unchanged, after preservation, in both *C. albomaculata* and *C. pulverata*, at least for some years. In life the color was "bright yellow green with maroon or rusty yellow dots. Below greenish white flesh, transparent; under-side of feet and hands light yellow."



FIG. 3. *Cochranella pulverata* (Peters). Upper figure KUMNH No. 32822; actual snout-vent length 22 mm. Lower figure, KUMNH No. 32821; actual snout-vent length 24 mm. Both specimens from Sarchi, Alajuela Province, C. R.

Cochranella albomaculata (Taylor)

(Fig. 4)

Centrolenella albomaculata Taylor. Univ. Kansas Sci. Bull., vol. 33, pt. 1, Apr. 20, 1949 (type locality, Los Diamantes, one mile south Guápiles, Limón Province, C. R.).

Four topotypic specimens, KUMNH Nos. 32824-27, were taken at Los Diamantes, near Guápiles, Limón Province, and a single female specimen, No. 32820, measuring 29.5 millimeters snout-vent



FIG. 4. *Cochranella albomaculata* (Taylor). KUMNH No. 32820. IAIA, Turrialba, Cartago Province, C. R. Actual snout-vent length, 29 mm.

length, was taken on a banana plant near a tiny stream draining a swampy area at Turrialba. Here many other specimens were heard calling from tall trees. The latter Turrialba specimen is figured, showing the details of the dorsal markings.

In life, the color was dark green above with discrete rounded greenish-yellow spots; venter transparent flesh; hands and feet

yellowish to orange yellow. Chin, and concealed part of arms and legs, pale green. The green color has changed to lavender in preservative. This form is most closely related to *Cochranella pulverata*.

Cochranella granulosa (Taylor)

(Fig. 5)

Centrolenella granulosa Taylor, Univ. Kansas Sci. Bull, vol. 33, pt. 1, Apr. 20, 1949 (type locality, Los Diamantes one mile south of Guápiles, Limón Province, C. R.).

A third specimen of this species, KUMNH No. 32808, was taken at Moravia de Chirripó, Limón Province, in 1952. It agrees with the type in all essential characters, save that in preserved specimen the dark lavender spots are larger. The specimen, a gravid female, measures 30 millimeters in snout-vent length. The ovarian eggs show some pigmentation.

The specimen was taken on a Chinese ginger plant near a small stream. Its color in life was "dorsal surfaces bright yellowish-green



FIG. 5. *Cochranella granulosa* (Taylor). KUMNH No. 32808, Moravia de Chirripó, Limón Province, C. R. Actual snout-vent length, 30 mm.

on back; the legs and concealed parts canary yellow, with tips of toes bright orange-yellow; venter transparent flesh with a greenish or yellowish wash; blackish on upper eyelids." When preserved the green disappears and the lavender pigment produces rather large dark lavender spots on a cream background.

Cochranella decorata sp. nov.

(Fig. 6)

Type: KUMNH No. 36896 ♀, collected at Hda. La Florencia, about 3 miles west of Turrialba, Cartago Province, Costa Rica, Nov., 1952, by Jack Reark.

Paratypes: KUMNH Nos. 36883, 36884, (presumably) San José, San José Province, summer 1954; Prof. Marco Tulio Pacheco, donor.

Diagnosis: A medium-sized species (maximum size known 22.8 mm. snout to vent); head wider than body, the length of eye-opening greater than the length of the snout, nearly equal to the distance of the eye from tip of snout; nostrils not reaching as far forward as edge of mouth; first finger longer than second; outer fingers about half webbed; the web between the second and third fingers one fourth of the length of second finger to pad; that between two inner fingers one fifth length of inner to its terminal pad; tibiotarsal joint reaches at least three millimeters beyond tip of snout; a prominent fold runs from sides of vent back and down on thigh; tongue not or scarcely notched behind; no vomerine teeth; no tympanum visible.

Description of type: Width of head (9 mm.) greater than body width and greater than length of head (8 mm.); width of an eyelid (1.3 mm.) twice in interorbital distance (2.6 mm.); nostrils not extending forward to level of mouth; distance between eye and nostril (1.8 mm.) nearly equal to distance between nostril and median point on upper lip (1.85 mm.); areas about nostrils not or scarcely swollen; no canthus rostralis; tympanum not visible; no supratympanic fold or only an indication of a slight thickening.

Tongue a little longer than broad, with a faint suggestion of a posterior notch; diameter of a choana (.7 mm.) in distance between choanae (1.8 mm.) about two and one-half times; palatal glands opening in a concave transverse groove between anterior edges of choanae. (Male with a subgular vocal sac, the vocal slits short terminating near edge of tongue.)

Upper arm very slender, unpigmented; forearm widened, the bones of the hand more or less visible externally; digits with terminal pads wider than the fingers; web of two outer fingers equals length of fourth finger to its terminal pad; web between second and third

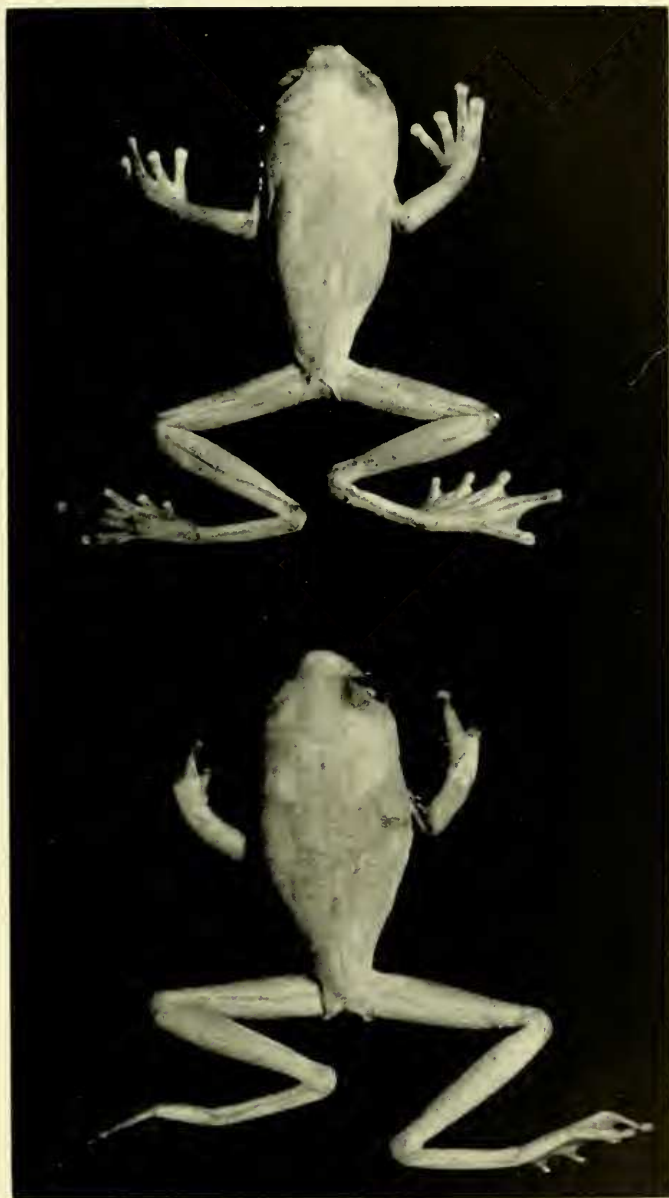


FIG. 6. *Cochranella decorata* sp. nov. Upper figure, KUMNH No. 36884, paratype, San José (?), San José Province, C. R. Actual snout-vent length, 22.5 mm. Lower figure, KUMNH No. 36896, type, Hda. La Florencia, Turrialba, Cartago Province, C. R. Actual snout-vent length, 22.8 mm.

fingers about one fourth of the length of second, with a fringe extending along edge of digit to pad, but lacking fringe on inner side of the fourth; a web-remnant between inner fingers; a flattened fold on outer side of hand and forearm. Subarticular tubercles small, distinct; a small inner metacarpal tubercle; a distinct oval or rounded palmar tubercle.

Legs elongate the heel reaching at least three millimeters beyond tip of snout; heels touch or barely overlap when folded at right angles; toes about four-fifths webbed; a slender, somewhat elongate inner metatarsal tubercle; no outer tubercle evident; a faint tarsal fold.

Skin on head smooth anteriorly, with some granules evident behind eye and at angles of the mouth; tympanum hidden under skin and muscles; under a lens dorsum shows obsolete granulation, as does upper surface of femur, tibia, and tarsus; venter and side granular, the venter tending to show transverse wrinkling; about half of undersurface of thigh smooth; posterior half somewhat granular or areolate; a strong skinfold running back and down on thigh, the anal flap somewhat thickened more or less connecting the two folds.

Color: In life, greenish above, with pale cream spots; transparent flesh below and on concealed surfaces of limbs. In preservation, at first, the green disappears leaving the ground-color yellowish white with small punctations of dark lavender. These too have now disappeared, leaving the dorsum unicolor.

Measurements in mm. (of type, No. 36384, and 36383 respectively): Snout to vent, 22.8, 22.5, 22.5; width of head, 9, 8.8, 8.9; length of head, 8, 7.5, 7.6; arm length, 14.8, 14, 14.2; leg, 39, 34, 35; tibia, 12.8, 11.4, 13; foot and tarsus 17.5, 16, 17.2.

Variation: The paratypes (not seen in life) in preservation have a scattering of lavender dots over body and the exposed parts of limbs. The skin on the dorsum of the paratypes is smoother than in the type and much of the femur is glassy smooth while the granulation is almost completely obsolete. The webbing on the hand is a trifle less than in the type. The donor of these specimens obtained them from his students. He believed them to have been taken at San José, San José Province.

Remarks: The character of the folds in the region of the vent separates this form from other known centrolenids of Costa Rica. A similar decoration appears on *Cochranella lutzorum* Taylor and Cochran, from Petropolis, Rio de Janeiro. In life there were orange

spots visible within the mouth on the palate, about the internal nares.

The type was taken from a leaf of Chinese ginger growing near a small fast-flowing stream.

The specific name is derived from the Latin *decoratus* = ornamented or decorated, referring to the folds about vent.

Cochranella millepunctata sp. nov.

(Fig. 7)

Type: KUMNH No. 36887; collected at La Palma, San José Province, Costa Rica, June 20, 1954 by Edward H. Taylor.

Paratypes: KUMNH Nos. 36883-86; 36888-94, topotypes, same data; No. 36897 Sarchi, Alajuela Province; No. 23943, (?) Moravia de Chirripo, Cartago Province.

Diagnosis: A small species, maximum size (♀) 23.8 mm.; nostrils not reaching forward to level of mouth, the areas surrounding them not elevated or swollen; front profile of snout nearly vertical, tympanum hidden; eye with a white tunic; no vomerine teeth; vocal sac present in males; terminal pads widened, distinctly wider than digits and rounded anteriorly rather than truncate; wide anal flap, the granules below vent "frosted" white; interorbital distance a fifth wider than width of an eyelid; legs folded the heels fail to meet; the tibiotarsal articulation brought forward reaches to tip of snout or slightly beyond; dorsum and head closely granular, the granules visible to eye; sides finely granular; lateral parts of venter granular, the median area vaguely so; toes about three-fourths webbed; outer fingers two-thirds webbed; less than one-fourth webbed between second and third fingers.

Description of type: Head a little broader than body; width of head (8.6 mm.) greater than length (7.3 mm.); eyes relatively small, moderately elevated, directed forward, the length of eye-opening less than its distance to tip of snout, longer than its distance from nostril; front of snout a rounded oval; nostril a little nearer mid-point on lip than to eye; no canthus rostralis; length of snout from front level of eye, two millimeters on mid-line; only a vague trace of a supratympanic fold.

Tongue (distorted in type) normally about as long as broad, free behind and on sides for about one seventh of its length; (male with vocal slits); choanae small, circular; diameter of choanae contained in distance between choanae about four times; openings of Eustachian tubes equal to or a little smaller than choanae.

Arm well developed, the fingers relatively short, the terminal pads widened, that of third finger largest (1.4 mm.) distinctly

wider than smallest width of digit (.9), the pads transversely oval; web between two outer fingers half length of fourth finger; between second and third, web about one fifth length of second finger; no web between the first and second fingers; first finger a little longer than second; fingers with slight lateral fringes except inner side of the third; a slight fold from base of first finger to elbow; no pigment on upper arm; forearm much widened at base; a small outer metacarpal tubercle; an oval palmar tubercle.

Leg long, the tibiotarsal articulation reaching two millimeters beyond snout; when legs are folded, heels touch and overlap (.5 mm.); toes two-thirds to three-fourths webbed, the terminal pads somewhat widened, the largest about as wide as that on first finger, smaller than pads on others; a small, slightly projecting metatarsal tubercle; subarticular tubercles of hand small, none double or bifid; those on toes a little smaller.

Skin above nearly smooth (under a lens very dimly granular on head, body and forearm); chin and breast smooth; venter with flat somewhat indistinct granules, more distinct laterally, obsolete on most of underside of thighs; anal flap wide transversely; vent followed by a quadrangular area of tubercles, frosted white; no anal folds.

Color in life: Above generally bluish green, with extremely numerous flecks of silvery white; eyeball with a white tunic; iris of eye whitish to golden, with numerous lavender flecks about rim; pupil longitudinal, with considerable purple flecking around it. Venter transparent flesh, the tips of the toes orange. Intestines visible through flesh, cream-white; a whitish covering also below the pericardial cavity. In preservation, the green disappears leaving a fine reticulation of lavender or magenta enclosing small white dots, much larger than the minute "frosted" white flecks seen in life.

Measurements in mm.: (type, No. 36895 largest male, and No. 36897 largest female, respectively): Snout to vent, 21.4, 21.5, 23.8; head width, 8.5, 8.8, 9.2; head length, 7.3, 7.2, 8; arm, 16, 15.5, 14.6; leg, 38.2, 37.5, 37; tibia, 12.3, 12, 12; foot and tarsus, 16.2, 16.3, 16.1.

Variation: There is but little variation in the specimens from La Palma. The specimen from Sarchi has a slightly wider head, slightly shorter limbs, and the webs between the toes are less excised. This specimen agrees with the type in coloration.

The type locality of *Cochranella valerioi* (Dunn) is likewise La Palma, San José Province. The two forms may be readily distinguished by color markings, *valerioi* having a green median stripe;



FIG. 7. *Cochranella millipunctata* sp. nov. Upper figure, KUMNH No. 36886, actual snout-vent length, 20 mm. Lower figure, KUMNH No. 36887, type; actual snout-vent length, 21.4 mm. Both specimens from La Palma, San José Province, C. R.

in the latter the area about the nostrils much swollen and protruding, the snout and nostrils actually projecting in front of mouth; a small tympanum is visible, and there is more webbing on hand. *Cochranella fleischmanni* is also known from La Palma. This species is larger with a white spot on the upper eyelid.

The transforming tadpoles of this species were taken with the types. One specimen, with tail completely absorbed, measures 13 mm. This was taken together with other tadpoles, some having tails three or four millimeters in length.

The specific name is derived from the Latin, *mille* = thousand, and *punctum* = small dot or spot; meaning, "thousand spotted."

Cochranella fleischmanni (Boettger)

(Fig. 8)

The type locality is San José, San José. Specimens are in the collection from the following localities: KUMNH Nos. 23807-08, 30399 Cartago, Cartago Province (Caribbean drainage); No. 36895, La Palma, San José Province, 4500 ft. elev.; Nos. 30400-02, Río Segundo, Alajuela Province (Pacific drainage).

Cochranella chrysops (Cope)

(Fig. 9)

Hylella chrysops Cope, Proc. Acad. Nat. Sci. Philadelphia, 1894, p. 196 (type locality [restricted], San José, San José Province, Costa Rica.)

Specimens of *C. chrysops* were found to be plentiful at Sarchi, Alajuela. Although formerly placed in the synonymy of *C. fleischmanni*, when directly compared with that species the two are found to be distinctly different; their ranges overlap a considerable extent on the Meseta Central of Costa Rica.

This form differs from *fleischmanni* in lacking a white eye tunic (and the "white spot" on upper eyelid); in having distinctly larger hands and wider digits; the first toe is shorter, the first and second being of equal length; the head is more distinctly set off from the body.

The largest male taken measures 24 millimeters in snout-vent length. The smallest fully transformed specimen was 9.2 millimeters in length.

The following localities are represented: KUMNH Nos. 32943-55, 32962-63, 32965-66, 32968-69, near Sarchi, Alajuela Province: No. 32956 (locality uncertain); Nos. 32957-59. Cartago, Cartago Province.

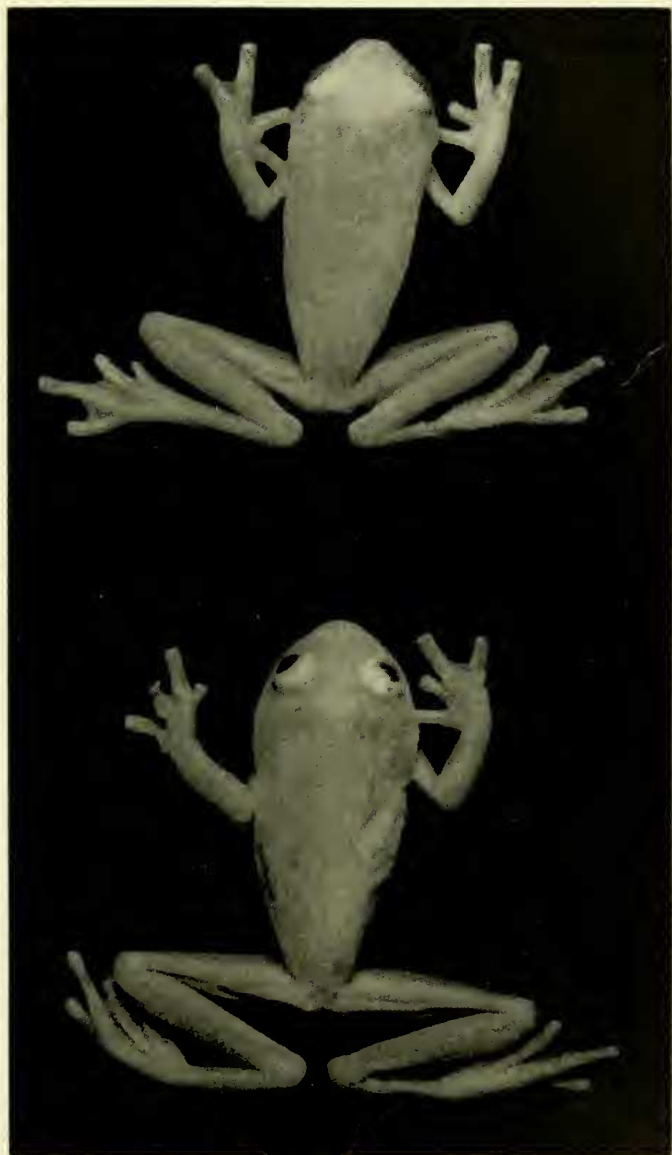


FIG. 8. *Cochranella fleischmanni* (Boettger). Upper figure, KUMNH No. 30401, actual snout-vent length, 23 mm. Lower figure, KUMNH No. 30400, actual snout-vent length, 23.8 mm. Both, Río Segundo, Alajuela Province, C. R.

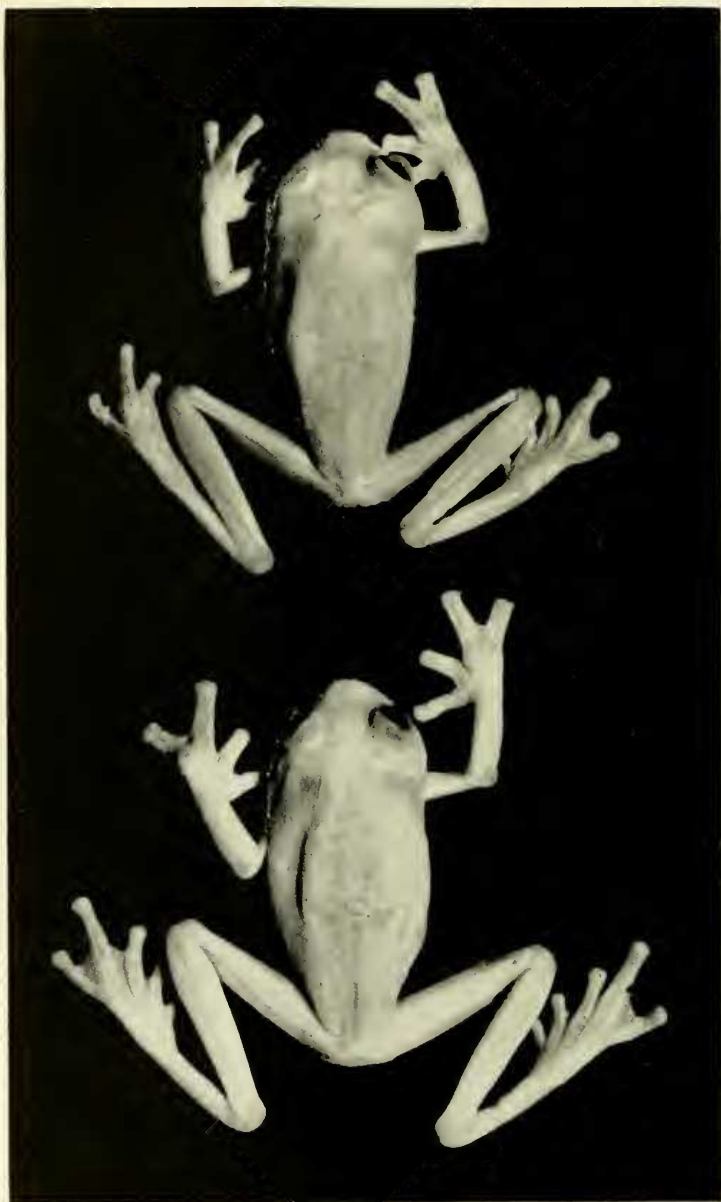


FIG. 9. *Cochranella chrysops* (Cope). Upper figure, KUMNH No. 34944, Pacayas, San José Province, C. R. Actual snout-vent length, 23 mm. Lower figure, KUMNH No. 32958, Cartago, Cartago Province, C. R. Actual snout-vent length, 24 mm.

Cochranella chirripoi sp. nov.

(Fig. 10)

Type: KUMNH No. 36865 ♀, collected on Cocales Creek, Suretka, Limón Province C. R., June 29-30, 1954, by Edward H. Taylor.

Paratypes: KUMNH Nos. 36862-64, 36866-70, topotypes, same data as type.

Diagnosis: A medium-sized species, the largest known, 26 millimeters in snout-vent length; no vomerine teeth; male with vocal sac; nostrils not extending forward beyond mouth; no canthus rostralis; tibiotarsal joint reaching two to three millimeters beyond tip of snout; heels overlap two millimeters when legs are folded at right angles to body; toes nearly fully webbed; web on hand as extensive between second and third fingers as between the third and fourth; tympanum somewhat indistinct, covered with finely granular skin; terminal digital pads on hand rather truncate, wider than narrowest part of finger. A white tunic about eyeball; skin granules distinctly visible to unaided eye.

Description of type: Head wider than body, its width (9.5 mm.) greater than its length (7.2 mm.); eye comparatively small, protruding but slightly beyond rim of mouth; no canthus rostralis; area about nostrils not or but slightly swollen or elevated (somewhat evident in certain paratypes); length of snout from front level of eyes, three millimeters; tympanum partly evident, its size uncertain, its surface covered with finely granular skin; width of eyelid (1.8 mm.) 1.55 times in interorbital distance (2.8 mm.); choanae relatively small, the diameter of one in distance between choanae, at least three times; openings of palatal glands in an undulating line, crossing palate closer to choanae than to front of palate; tongue a little wider anteriorly than posteriorly, unnotched on posterior edge, free for less than one sixth of its length; (a vocal sac present in male, the vocal slits rather far back, reaching to near the angle of the jaw).

Upper arm very slender, unpigmented, the forearm double width of upper arm; web between second and third fingers almost co-extensive with that between third and fourth fingers; web between first and second finger one third length of second digit to terminal pad. The terminal digital pads one-fourth wider than narrow part of digits; outer metacarpal tubercle small; a somewhat rounded palmar tubercle; subarticular tubercles low, flattened, single; a strong fold on outer edge of hand extending to elbow.

Leg brought forward the tibiotarsal articulation reaching two millimeters beyond tip of snout; toes nearly fully webbed, the webs

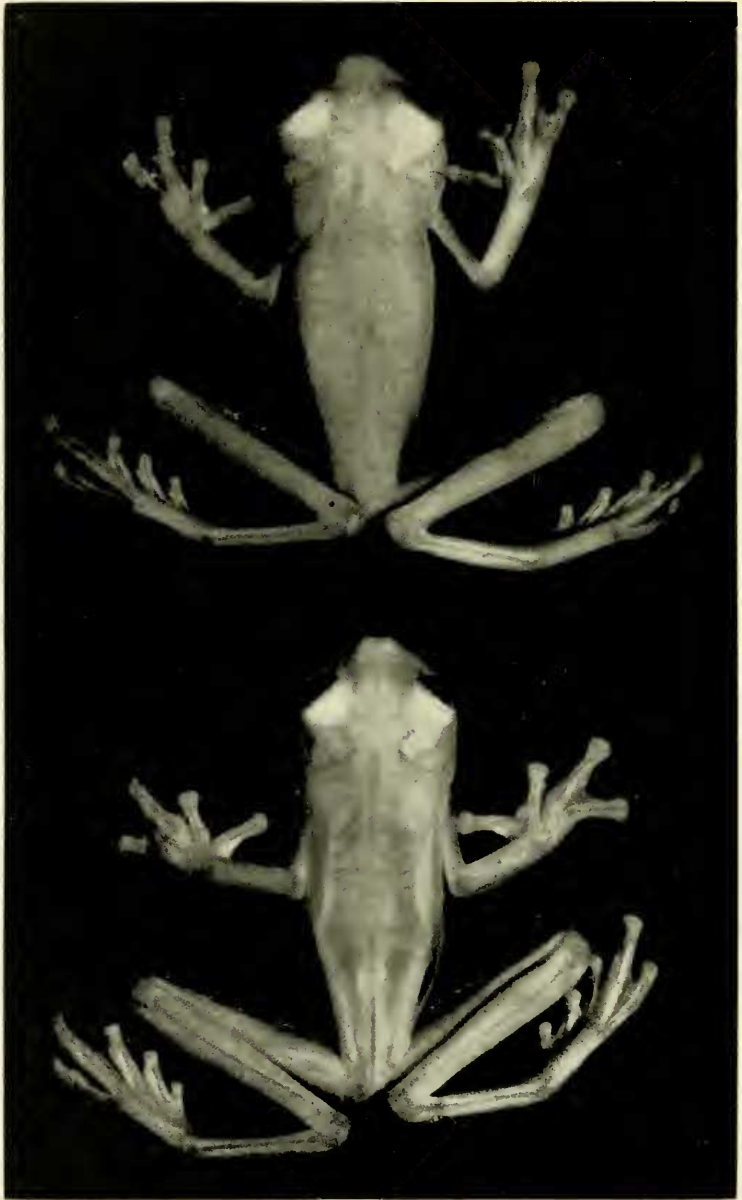


FIG. 10. *Cochranella chirripoi* sp. nov. Upper figure, KUMNH No. 36865, type; actual snout-vent length, 26 mm. Lower figure, KUMNH No. 36867; actual snout-vent length, 25.7 mm. Both from Suretka, Limón Province, C. R.

reaching the terminal pads (except fourth), the webs slightly excised between toes; digital pads smaller than those on fingers; inner metatarsal tubercle distinct, somewhat elongate; outer indistinct or absent; a distinct tarsal fold.

Skin above on exposed surfaces covered with distinct granules visible to unaided eye and present also to some degree on arm; chin and breast smooth; venter strongly granular, the skin on the sides with short folds rather than granules; most of the undersurface of thigh granular; below vent an area in which the skin, covered with large granules, appears to be folded vertically; undersurface of tibia and tarsus smooth.

Color: Exposed surfaces greenish in life the color extending onto upper arm, and distinctly along upper surface of femur; distally on limbs the color reaches onto outer finger and on the two outer toes for some distance. When preserved for some time the green is replaced, and a sparse peppering of lavender or magenta dots is evident (at least so under a lens). Venter slightly yellowish flesh, transparent; digital tip orange; some pigment below vent.

Measurements in mm. (Nos. 36865, 36866, 36869 respectively): Snout-to-vent length, 26, 24, 25; width of head, 9.5, 8.5, 8.9; length of head, 7.2, 8, 8; arm length, 17, 16, 16.3; leg, 44.5, 41, 46; tibia, 14, 13, 14.5; foot and tarsus, 18.3, 17.5, 18.9.

Variation: The series of paratypes is fairly uniform save that in certain ones the white eye tunic seems to be retracted but can be seen near the base of upper eyelid; the eyeball seen from the mouth also appears dark over most of its surface.

The leg of No. 36869 is proportionally longer, the heel reaching more than three millimeters beyond the tip of the snout.

Remarks: The hands of this species have a greater amount of webbing than other species of Costa Rican centrolenids, and by this character it may be separated from the other known forms.

Specimens were discovered by following up their calls. They were found in shrubs and low branches of trees along Coeales Creek, a fast moving, shallow stream ten to fifteen feet wide.

The species is named for the local inhabitants of the area, the Chirripo Indians.

Cochranella reticulata sp. nov.

(Fig. 11)

Type: KUMNH No. 32922, collected near bridge across Río Reventazón at the Inter-American Institute of Agriculture, Turrialba, Cartago Province, Costa Rica, by Edward H. Taylor.

Paratypes: KUMNH Nos. 32921, topotype, same data; No. 32916 Moravia de Chirripó, Limón Province, June 26, 1952; Nos. 32917-20 Cariblanco,

Heredia Province, July 20, 1952; Nos. 32923-24 Palmar, Puntarenas Province, Sept. 3, 1952; No. 32925 Golfito, Puntarenas Province, September 7, 1952 (breeding); No. 36878-82 Suretka, Limón Province, June 30, 1954 (breeding).

Diagnosis: Small, maximum size ♀ 23 mm., male 22.5 mm.; greatest diameter of tympanum, about two and one-half times in length of eye; interorbital width greater than width of eyelid; no canthus rostralis; nostrils moderately prominent, nearly on a level with the anterior edge of mouth; a slight supratympanic fold not reaching eye; venter and underside of thighs granular; one-half to three-fifths webbed between two outer fingers; one-fourth, or slightly less than one-fourth webbed between second and third; only a web-remnant between inner fingers; toes about four-fifths webbed; a tarsal fold; head a little wider than body; body flesh-green above with a reticulum of deep green; eyelids deep green. The tunic of eye dark; venter and underside of limbs transparent flesh; in preservative, a reticulum formed of small groups of lavender dots.

Description of the type: Width of head, at tympanum (8 mm.) greater than length (6 mm.); eyes large, strongly elevated, protruding beyond edge of mouth; length of eye (3 mm.) greater than length of snout (2 mm.); no canthus rostralis, the loreal region not concave; area about nostrils somewhat swollen, with a slight depression anteriorly; tip of snout extending about 0.8 millimeters beyond mouth; tympanum (1.3 mm.) relatively large, contained in length of eye-opening (3.0 mm.) about two and one-half times, directed outward and upward, completely visible from above; a tiny supratympanic fold begins above tympanum and continues to above arm; interorbital width (2.2 mm.) greater than width of eyelid (1.8 mm.).

Tongue slightly free behind and slightly notched; no vomerine teeth; choanae subcircular, the diameter of one contained in interchoanal distance nearly three times; palatal glands open into a transverse groove slightly in advance of level of choanae; vocal slits opening into a large subgular vocal sac.

Upper arm very slender, unpigmented; forearm much thickened with a prominent fold from wrist to elbow; inner metacarpal tubercle elongate, scarcely elevated; median palmar tubercle rounded, rather prominent; outer subarticular tubercles on first, third, and fourth fingers double or bifid; other small tubercles on palm; fingers broad, not or but slightly widened at tips, terminally subtruncate. Web between two outer fingers slightly more than half of the length

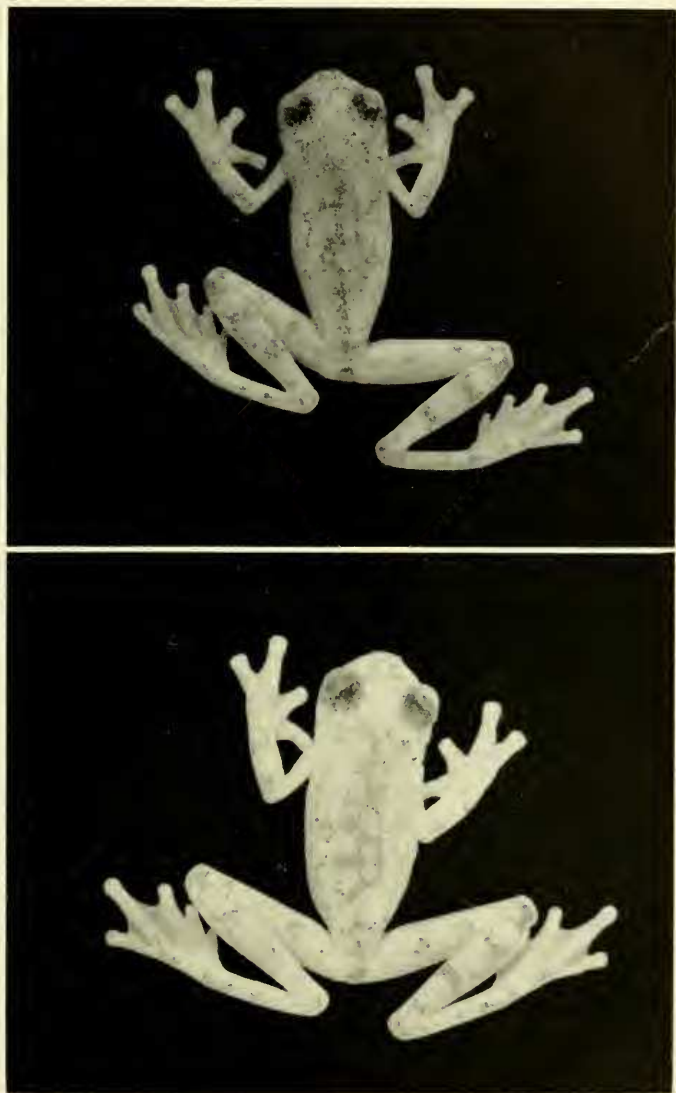


FIG. 11. *Cochranella reticulata* sp. nov. Upper figure, KUMNH No. 32921, paratype, actual snout-vent length, 23 mm. Lower figure, KUMNH No. 32922, type, actual snout-vent length, 22 mm. Both specimens from Inter-American Institute of Agriculture, Turrialba, Cartago Province, C. R.

of fourth to terminal disc; about one-fourth webbed between second and third fingers; only a remnant of web between two inner fingers; a strong fringe to disc on outer side of second and third fingers and on inner side of fourth; a slight fold on outer side of palm; first finger longer than second; subterminal pads subtriangular. Leg slender, the heel reaching the tip of snout (probably slightly beyond, normally); when legs are folded, the heels touch; toes four-fifths webbed, the web reaching to near level of the subterminal pads, except on fourth toe.

Skin above (under a lens) somewhat granular; a very shallow depression between eyes; venter and underside of thighs granular; a pair of larger rounded areolae or granules near median point under thighs.

Color: Above generally greenish flesh with a reticulation of darker green surrounding large circular cream areas; upper surface of hands and feet cream to yellowish; ventral and concealed surfaces transparent flesh. In preservative, cream-white with a reticulum composed of lavender dots surrounding rounded areas.

Measurements in mm.: Snout-to-vent length, 22; width of head, 8; length of head, 6; length of arm, 14; leg, 40; tibia, 13; foot and tarsus, 17.

Variation: The specimens of this species available show a close similarity in size between the sexes. There is practically no difference in coloration. Specimens in preservative (formalin, transferred to alcohol) tend to have the green color turn to lavender or purple which is slowly dissolved in alcohol. When this happens the color of the muscles may give the appearance of two lighter lateral stripes extending to pelvis with a very slightly darker and wider median stripe. The eyes appear black. After nearly five years in preservative the dorsal pigment marks can still be seen under a lens. The dorsal surface of thigh has scattered pigment but the hands and feet (except outer toe) are without pigment.

The tongue varies somewhat in shape in preservation, but usually it is a little wider posteriorly than anteriorly and a slight notch is indicated.

Remarks: All of the series listed are adult. Most of them were discovered by following calls, the specimens being found on the underside of leaves. Two pairs were found breeding, and in two cases single males (one the type) were observed brooding sets of

eggs under a leaf. The type was taken from a palm-tree leaf at least 25 feet above the ground. It was dislodged by a long bamboo pole. Almost directly under the eggs was a tiny rivulet flowing over rocks, entering the Río Reventazón at a point some fifty feet away. The call is reminiscent of the call of certain local orthoptera (katydids).

Specimens taken at Cariblanco were found at night perched on smooth leaves overhanging a swift-moving irrigation canal. They were not calling. Two females, Nos. 32916 and 32923, are gravid.

Cochranella valerioi (Dunn)

Centrolene valerioi Dunn, Occ. Papers Boston Soc. Nat. Hist., vol. 5, Aug. 18, 1931, pp. 397-398. (type locality La Palma, San José Province, C. R. [4500 ft. elev.].)

No specimens of this species have been taken although search has been made in the type locality. Dunn described the species as follows:

Diagnosis: "Centrolene without humeral hooks, no vomerine teeth; tympanum almost aborted; nostrils raised prominently; bones white; color in life white with a dorsal green network.

Description: "Tongue circular; head broader than long, semi-circular as seen from above save for projection made by nostrils; eyes directed forward, their diameter greater than their distance from tip of snout; canthus rostralis rounded but distinct; lores concave; nostrils protuberant, causing snout to overhang; interorbital space twice as wide as upper eyelid; tympanum barely visible, directed upward, $1/6$ the diameter of eye; fingers with disks wider than tympanum, truncate; first finger longer than second; web on about $1/2$ of outer fingers, to penultimate phalanx of 3 and 4; inner fingers webbed at base; toes webbed to just short of disks of 3 and 5, not quite to penultimate phalanx of 4; a single weak inner metatarsal tubercle; heel reaches to beyond snout; smooth above, belly and thighs rugose; in life white, a narrow green dorsal stripe, green vermiculations on dorsal surface and on shin, thigh unpigmented, white beneath, iris golden, in preservative white, a few faint dark chromatophores where green was in life; length 21 mm., width of head 8; arm 13, leg 39 mm."

I examined a specimen presumed to be a paratype, a short description of which was published by me (Univ. Kansas Sci. Bull.,

vol. 35, pt. 1, no. 5, July 1, 1952). This specimen may or may not be of the same species. I have not compared it with the type. The species appears to be related to *Cochranella talamancae* despite obvious differences. Further study is essential before the status of these two forms is fixed.

Cochranella talamancae Taylor

(Fig. 12)

Cochranella talamancae Taylor, Univ. Kansas Sci. Bull., vol. 35, pt. 1, July 1, 1952, pp. 781-783 (type locality, Moravia de Chirripó, Limón Province, C. R.).

This diminutive species (approximately 22 mm. snout-vent length) was rediscovered at the type locality, Moravia de Chirripó, Limón Province.

The following were taken: KUMNH, Nos. 30887, 32936-38 topotypes.

In life the ground color of the specimens was delicate canary yellow with a diffuse green median line joined to a fine greenish reticulation, enclosing lighter areas on dorsum. Chin bluish white, the venter transparent cream-flesh; concealed parts of limbs flesh; upper eyelid dark green over black; iris golden, powdered with deep purple; webs of hands and feet less intense yellow than on the tips of fingers and toes; on dorsal surface of legs there are slightly rounded yellow spots.

This may be the southern representative of *Cochranella valerioi* (Dunn), which appears to be its nearest relative. I have not found *C. valerioi* although I searched for it at La Palma, the type locality.

Cochranella colymbiphylum (Taylor)

(Fig. 13)

Centrolenella colymbiphylum Taylor, Univ. Kansas Sci. Bull., vol. 33, pt. 1, Apr. 20, 1949, pp. 262-263 (type locality, American Cinchona plantation [Isla Bonita] Volcán Poás, Heredia Province, Costa Rica).

This species is presumably confined to the northern and eastern drainage of the Cordillera Central. The following specimens, other than the types, are in the collection: KUMNH, Nos. 32939-32941 Cariblanco; No. 32942, topotype, Cinchona (Isla Bonita), both from Heredia Province.



FIG. 12. *Cochranella talamancae* Taylor. Upper figure, KUMNH No. 32937 topotype, actual snout-vent length, 21 mm. Lower figure, KUMNH No. 32938, topotype, actual snout-vent length, 21.5. Both from Moravia de Chirripó, Limón Province, C. R.

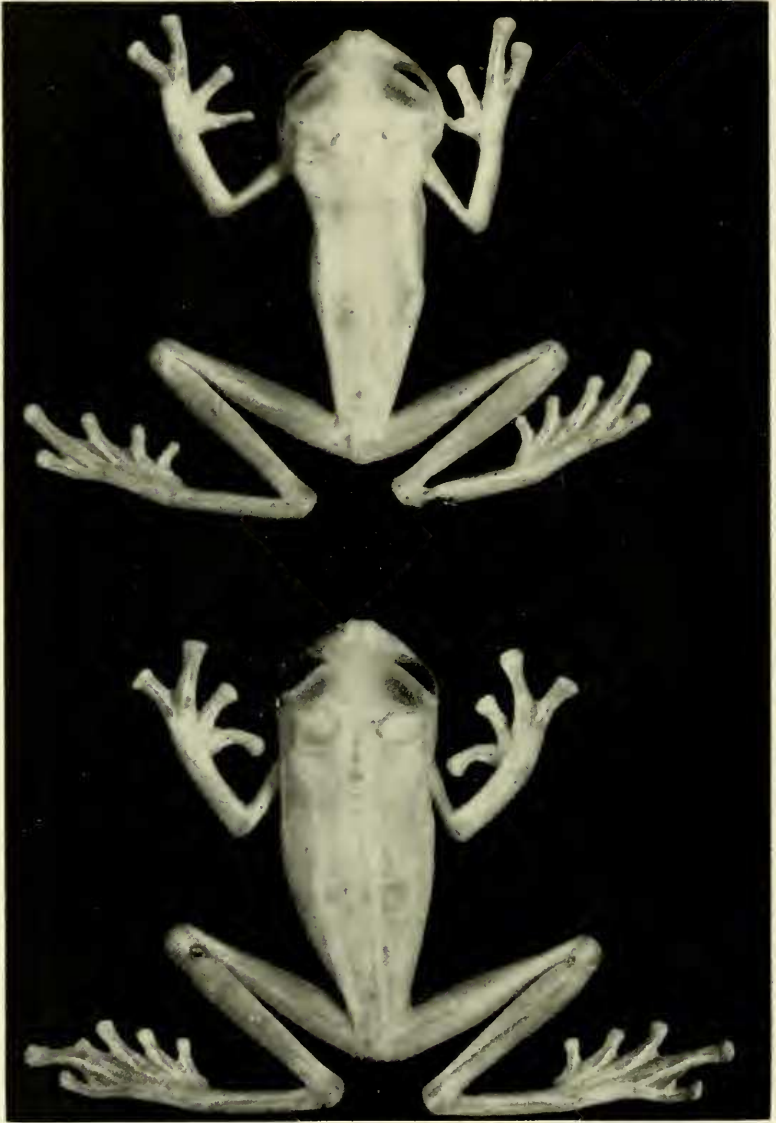


FIG. 13. *Cochranella colymbiphyllum* (Taylor). Upper figure, KUMNH No. 23812, type, actual snout-vent length, 26 mm. Lower figure, KUMNH No. 32942, topotype, actual snout-vent length, 26.2 mm. Both from Isla Bonita [= Cinchona], Heredia Province, C. R.